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ABSTRACT

A project was conducted by Manchester Community College and Howell Cheney Vocational Technical School in Connecticut to develop a joint curriculum for a two-year computer technology and maintenance program. During the year the project was conducted, a high technology advisory council was formed, consisting of industry and faculty representatives and State Department of Education personnel. The committee discussed educational needs for the program and developed a curriculum and outlines of courses. The curriculum will be either a 30-hour certificate program or a two-year degree program. The target population will be those who wish to enter a high-technology field with growth potential. Courses were scheduled to be offered in the Fall semester of 1985, with the full program in place within the following one and one-half years. It was estimated that the program could accommodate 25-35 full-time students per year. (This report contains the curriculum outline and course descriptions for the following courses: electrical circuits, electronic devices, logic circuits I and II, minicomputer systems I and II, diagnostic instrumentation, and applied microprocessors.) (KC)

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COMPUTER TECHNOLOGY AND MAINTENANCE CURRICULUM

FINAL REPORT

PREPARED BY

MANCHESTER COMMUNITY COLLEGE

60 BIDWELL STREET

MANCHESTER, CONNECTICUT 06040

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PREPARED FOR

CONNECTICUT STATE DEPARTMENT OF EDUCATION

DIVISION OF VOCATIONAL, TECHNICAL AND ADULT EDUCATION

BUREAU OF VOCATIONAL SERVICES

HARTFORD, CONNECTICUT

PROJECT DIRECTORS:

JOHN V. GANNON
ASSOCIATE DEAN, COMMUNITY SERVICES
MANCHESTER COMMUNITY COLLEGE
MANCHESTER, CONNECTICUT

LAWRENCE IERARDI, DIRECTOR
HOWELL CHENEY VOCATIONAL TECHNICAL SCHOOL
MANCHESTER, CONNECTICUT

THIS PROJECT WAS SUPPORTED BY FUNDS MADE AVAILABLE TO CONNECTICUT THROUGH THE VOCATIONAL EDUCATIONAL ACT OF 1976, PUBLIC LAW 94-482.

ALL OPINIONS EXPRESSED REFLECT THE VIEWS OF THE AUTHORS AND ARE NOT NECESSARILY THOSE OF THE STATE DEPARTMENT OF EDUCATION.

JUNE 10, 1985

CE042906

ABSTRACT PAGE FORMAT

TITLE OF PROJECT: Computer Technology and Maintenance

PROJECT DIRECTOR: John V. Gannon/Lawrence Ierardi

APPLICANT ORGANIZATION: Manchester Community College

TOTAL PROJECT FUNDS REQUESTED: $5988.79

Beginning Date: July 1, 1984 Ending Date: June 30, 1985

OBJECTIVES:

1) To develop a curriculum for a computer technology and maintenance program as a joint venture between Manchester Community College and Howell Cheney Vocational Technical School.

2) To implement the program on the 1985 fall semester.

3) To form a High Technology Advisory Council to assist in this curriculum project and in other technical areas.

PROJECT DESIGN:

Manchester Community College and Howell Cheney Technical School are the principal schools involved in this curriculum project. Both schools will share responsibility for curriculum development, provide classrooms and technical facilities and assist in the promotion of the program. The curriculum will be completed by October 1, 1984 and will be either a 30 hour certificate program or a two year degree program. The target population will be those who wish to enter a high technology field with growth potential. This collaborative effort can serve as a model for other schools in Connecticut.

CONTRIBUTION TO VOCATIONAL EDUCATION:

This program will make a significant contribution to vocational education by implementing a high technology program for which there is a demonstrated need. The role of the Advisory Council will also be important in keeping Manchester Community College and Howell Cheney Vocational Technical School apprised of the direction of high technology so that educators may more closely follow trends and manpower needs.

STATE OF CONNECTICUT
MANCHESTER COMMUNITY COLLEGE
MANCHESTER, CONNECTICUT 06040

Members of Advisory Committee for the vocational improvement project "Computer Technology and Maintenance Curriculum".

Mr. J. Thomas Horan
Aetna Life and Casualty
151 Farmington Avenue, C-351
Hartford, CT 06156

Mr. William Zielor
Harris Corporation
850 Silas Deane Highway
Wethersfield, CT 06109

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Burroughs Corporation
20 Founders Plaza
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Mr. John Alberghini
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Mr. John V. Gannon
Associate Dean, Community Services
Manchester Community College
P.O. Box 1046, MS #5
Manchester, CT 06040

Lawrence Ierardi, Director
Howell Cheney Vocational Technical School
791 Middle Turnpike West
Manchester, CT 06040

Also attending the October 31st Advisory Committee meeting:

Ken McDonald - Harris Corporation
Russ Jolin - Harris Corporation
Jack Morrison - Harris Corporation
Dr. Valerie Pichanick - State Department of Education

STATE OF CONNECTICUT

MANCHESTER COMMUNITY COLLEGE

MANCHESTER, CONNECTICUT 06040

MINUTES OF
COMPUTER TECHNOLOGY AND MAINTENANCE CURRICULUM PROJECT
ADVISORY COMMITTEE MEETING

October 31, 1984

Members of Advisory Committee attending: J. Thomas Horan, James Thurber, William Zielor, Donald Camper, John Alberghini, Lawrence Ierardi, John Gannon, R. Dianne K. McHutchison, Valerie Pichanick.

Member of Advisory Committee unable to attend: Louis Hailey

Guests from Harris Corporation: Ken McDonald, Russ Jolen, Jack Morrison

The luncheon meeting of the Advisory Committee for the Computer Technology and Maintenance Curriculum Project was held at Manchester Community College on October 31, 1984.

John Gannon, Associate Dean of Community Services at Manchester Community College briefly outlined the history of the project and explained the circumstances which led the college to apply for the grant funds from the State Department of Education to develop this curriculum. Copies of the completed curriculum were distributed to those present.

Dr. John Alberghini, Professor of Physics at Manchester Community College and Louis Hailey, Instructor in the Electronics Department at Bullard Havens Vocational Technical School in Bridgeport jointly developed the curriculum over the summer. John Alberghini reviewed the completed curriculum, and explained the procedures for the necessary approvals within the College.

Lawrence Ierardi, Director of Howell Cheney Vocational Technical School in Manchester outlined the association which his school will have with the curriculum project, including the availability of computer facilities at Howell Cheney.

Dr. Valerie Pichanick, Program Manager at the Bureau of Vocational Program Planning and Development at the State Department of Education commented on the role of her department and some of the project requirements.

Dr. John Alberghini requested that any additions to the curriculum should be sent to him by the end of November.

Larry Ierardi offered to host the next meeting of the Advisory Committee at Howell Cheney Technical School in Manchester.

January 3rd, 1985 was set as the date for the next Advisory Committee meeting.

Respectfully submitted,

R. Dianne K. McHutchison (Mrs.)
Director, Contract and Grants
Manchester Community College

RDKMcH:sm

STATE OF CONNECTICUT

MANCHESTER COMMUNITY COLLEGE

MANCHESTER, CONNECTICUT 06040

Minutes of The
Computer Technology and Maintenance Curriculum Project
Advisory Committee Meeting
Thursday, January 3, 1985

Members of Advisory Committee attending: J. Thomas Horan, Donald Camper, Mario Fiondella, Jack Gannon, Lawrence Ierardi, Dianne McHutchison. ABSENT: James Thurber, John Alberghini, William Zielor.

The second meeting of the Advisory Committee was convened at 9 a.m. on January 3, 1985, in the Lowe Building at Manchester Community College.

The main topic for discussion was the letters received by Dr. John Alberghini from members of the Advisory Committee. These letters contained suggestions regarding the content of the curriculum.

One of the ideas presented in Tom Horan's letter was in regard to the need for humanistic education, including speaking, reading, and writing, and development of interpersonal skills.

Tom Horan stated that the role of the serviceman is changing and that all serviceman will need both technical information and the know how to be a problem solver.

Growth in the service area for computer technology is anticipated over the next several years. It was agreed that the technical courses as presented in the curriculum are sufficient to build a career. However, concern was expressed regarding the areas of professional relations and problem solving techniques.

The suggestion was made by Jack Gannon that Psychology 120 would be a good addition to the curriculum.

Tom Horan agreed to assist in developing a broad based deductive course in professional relations and problem solving, which would be generic enough to cross many academic areas.

Dianne McHutchison announced that a dissemination workshop for the purpose of sharing the results of this project will be held in April.

Mario Fiondella reported that all interanl approvals for this curriculum would be expected by March.

The next meeting will be on Wednesday, June 5, at 9:30 a.m.

This meeting was adjourned at 10:20 a.m.

FACULTY SENATE

Minutes of March 5, 1985 Meeting

1. Meeting Called to Order at 3:11 p.m.

2. Agenda **APPROVED**

3. Minutes of February 5, 1985 Meeting **APPROVED**

4. **New Business** - none

5. **Announcements**

B. Smaga - OTA program has been reaccredidated for five years which is maximum approval. Report stated that all faculty appear to be dedicated to quality education.

H. Meisel - The Regional Advisory Council will again be presenting their annual award to an outstanding graduate of MCC. Please submit names and a list of the activities they are involved in to the Dean of Student Affairs by March 13.

T. Tamarkin - Urged members to attend an aerobics class that is held twice a week (Tuesday & Thursday) from 12:30 to 1:30 in the old library. If more participants are not found, class will be cancelled.

6. **Old Business** - none

7. **Committee Reports**

A. **Faculty Senate Executive Committee** - J. Crowley
Thanked faculty and staff for painting classrooms on the East campus. Painting will continue on Friday and Saturday for two more weeks.

B. **Academic Standards** - W. Shorey
After a lengthy discussion on what happens to a students GPA when a student retakes a course, the recommendation of the Academic Standards Committee was **APPROVED** as follows:

1) **All grades show on the record**
2) **All grades be used in computing the GPA**
3) **Grade computation policy be printed in the College Catalog and Student Handbook.**

C. **Curriculum Committee** - A. Guinness

APPROVED **Fine Arts 138**
Fine Arts 239
Fine Arts 240
(These are the continuation of basic Fine Arts Courses)

-over-

C. Curriculum Committee (con't.)

NEW COURSES
APPROVED

History of Women in the USA
Ireland in America
From Village Green to Mill Town
American Families
Crime, Punishment and Justice in America

NEW COURSES - Computer Maintenance Technology Progam in a cooperative program with Howell Cheney Technical School.
APPROVED
EL 113 - Electrical Circuits
EL 114 - Electronic Devices
EL 120 - Logic Circuits I
EL 121 - Logic Circuits II
EL 122 - Mini-Computer Systems I
EL 123 - Mini-Computer Systems II
EL 124 - Diagnostic Instrumentation
EL 126 - Applied Microprocessors

NEW COURSES - One credit courses are required options in the DP Degree Program and the DP Certificate Program.
APPROVED
DP 151 - Business Basic I
DP 152 - Business Basic II
DP 153 - Computer Editors
DP 154 - Information Management I
DP 155 - Information Management II
DP 156 - Data Base Management I
DP 157 - Data Base Management II

D. College Senate - D. Gidman
The committee on advising recommended that students having zero to twelve hours receive advising. Nothing will be done until the Senate hears a report from the President's task force on advising.

Draft proposal of 1986/87 calendar has been received.

E. Media - M. Flynn
Finalizing plans for the Photography Symposium.

8. Questions
Discussion ensued regarding the policy of closing/late opening of college due to weather conditions.

9. Meeting adjourned at 4:00 p.m.

/jp

Special Note: When instructors must cancel an 8:00 a.m. class, unexpectedly, the switchboard operator will receive a call after 7:30 a.m. and Security will post on classroom.

STATE OF CONNECTICUT

MANCHESTER COMMUNITY COLLEGE
MANCHESTER, CONNECTICUT 06040

AGENDA FOR DISSEMINATION WORKSHOP

April 29, 1985

1:15 - 1:30 PM	Registration, refreshments, and distribution of materials
1:30 PM	Welcoming remarks: John V. Gannon, Dean of Community Services, Manchester Community College Kenneth Gray, Superintendent of Vocational Technical Schools
1:45 PM	Dr. Valerie Pichanick, Program Manager, Bureau of Vocational Program Planning and Development, Department of Education
2:00 PM	Dr. Lawrence Ierardi, Director, Howell Cheney Technical School Dr. Robert Barde, Dean of Academic Affairs, Manchester Community College
2:15 PM	"Development of Curriculum and Implementation" John Alberghini, Professor of Physics, Manchester Community College Mario Fiondella, Academic Division Director, Math, Science and Allied Health, Manchester Community College
2:30 PM	Comments by members of the Advisory Committee
2:45 - 3:00 PM	Questions, concluding remarks, and refreshments

HIGH TECHNOLOGY ADVISORY COMMITTEE MEETING

June 5, 1985

Present: Tom Horan, Jim Thurber, Don Camper, Dr. Valerie Pichanick, Jack Gannon, Dianne McHutchison.

The meeting began at 9:45 A.M.

The meeting started with a discussion of the final curriculum and the changes which have been incorporated. These changes include the addition of Psychology 240/Business 240 and Speech 213.

Valerie Pichanick asked about the status of the program approval process. Jack Gannon said that Mario Fiondella, Academic Division Director of the Math, Science and Allied Health Division is responsible for guiding this program through the process.

A brief report was given by Dianne McHutchison regarding the Dissemination Workshop, which was held on April 29th.

Tom Horan asked about the math requirement for those entering the program. It was agreed that any publicity regarding the program should include the requirement for a satisfactory score on the math placement exam.

Jack Gannon indicated that one or two of the introductory courses will be offered in the 1986 spring semester and that by the fall of 1986, the full program could be offered. It is anticipated that by the 1986 fall semester, all approvals will have been received.

Tom Horan suggested that in the summer of 1987, students in the program be given the opportunity for a summer internship with a company. The internship will not be required, but would be recommended. The internship can be used as a marketing technique for the program and will also provide feedback to the college regarding the program. Tom Horan offered to refer some people to courses which will be given in the 1986 spring semester. It will be important to make contacts with other companies who would be willing to take interns.

Jim Thurber stated that customers today want better equipment and less maintenance and so field engineering opportunities are shrinking. Increasingly, the shift will be toward fewer technicians, more marketing skills and throw away hardware and components.

For the future, Tom Horan sees jobs as computer technicians still in existence but predicted the nature of the maintenance function is changing. The skills

MANCHESTER COMMUNITY COLLEGE

PROPOSAL

COMPUTER MAINTENANCE TECHNOLOGY PROGRAM

PREPARED BY:

Dr. John E. Alberghini
Professor of Physics
Department Head

I. STATEMENT OF THE PROPOSAL

The intent of this program is for Manchester Community College and Howell Cheney Vocational Technical School in Manchester to collaborate in developing and implementing a two year degree program in computer technology and maintenance. This program will provide jobs in a highly technical area of increasing demand in the State of Connecticut as stated by Hugo Wilms in his article, "Emerging High Technologies--Opportunities in Connecticut":*

> "All interviews emphasized the need for technicians well rounded in the fundamentals of math and science, together with the ability to communicate well, both written and orally. ...Most believed that a knowledge of basic computing technology would be required for all technicians in the near future."

Three target groups have been identified who would benefit from this type of program:

1) People who already have an Associate Degree or higher in computer technology or a related technical area, but who find they need additional courses in computer maintenance in order to be competitive in the job market.
2) Those presently in the job market without any prior post-secondary training who find they need the basic courses in electronics, math and physics in order to advance into computer technology jobs which require training at the post-secondary level. Also, this program is suitable for the displaced worker who needs a new skill in order to find employment.

*Prepared for the Connecticut State Department of Education, Division of Vocational and Adult Education, August 12, 1983.

3) Those who are just out of high school with little or no prior work experience who want to enter a high technology field which has growth potential.

The publication, "Connecticut Occupational Projections and Training Data" for fiscal year 1984 supplies information on anticipated labor resources and occupational demand to assist educators in designing vocational educational programs of study. This report states that there will be a strong demand for electrical technicians to service computers as they become increasingly used in the business community.*

The computer industry is a dynamic, rapidly expanding industry with more than a dozen manufacturers within commuting distance of Hartford. As a result of this rapid expansion, there is a critical shortage of trained technicians, and the prospects for employment and advancement opportunities are excellent.

Computer Maintenance Technicians install and service computers and computer systems. They routinely inspect and maintain these systems and test them for defective components. Others work as Research and Development Technicians.

If Community Colleges and vocational schools are to be successful in offering training programs for new technical occupations, we must be increasingly responsive to the skills being demanded in the workplace. Computer maintenance technicians are needed not only in the high technology industries like electronics, robotics, lasers and bioengineering, but also in commercial establishments to accompany the increased use of automated work processing systems.

The article, "Emerging High Technologies--Opportunities in Connecticut" by Hugo Wilms states that Connecticut is falling behind in view of the rapidly expanding needs of industry for high technicians. The article also listed computing

*Annual Report "Connecticut Occupational Projections and Training Data". Fiscal Year 1984. State of Connecticut publication.

technology as one of the areas having high potential for the Connecticut workforce.

Presently there does not exist a computer technology and maintenance program at a public institution in the Greater Hartford area.

A High Technology Advisory Council will be formed with representatives from area business and industrial firms. The purpose of the Council will be to assist in the development of the Computer Technology and Maintenance curriculum and to provide on-going advice in other related technical fields. The Director of Howell Cheney Vocational Technical School and the Dean of Community Services at the College will serve as Project Directors and as chairmen of the Advisory Council.

The target population will be those who wish to enter a high technology field with tremendous growth potential. It is anticipated that the computer technology and maintenance field will provide employment in manufacturing firms, and in commercial establishments.

In the State of Connecticut publication, "Occupational Projections and Training Data: Annual Report, Fiscal Year 1984", it was estimated that half of the 960 job openings expected in engineering and related technologies will be electrical and electronic technicians. The report states that there will be a strong demand for these technicians to service computers.

This collaborative effort between Manchester Community College and Howell Cheney Vocational Technical School can serve as a model to other schools in the State of Connecticut. The sharing of faculty and facilities and the joint concern that new technology be reflected in course offerings, and that course offerings need to remain current in a changing technological environment, presents a unique opportunity for both schools to join forces with business and industry.

OBJECTIVES

1) To develop a curriculum for a computer technology and maintenance program as a joint venture between Manchester Community College and Howell Cheney Vocational Technical School, for submission to the Board as a proposal for two year degree program.
2) To implement the computer technology and maintenance program in the 1985 fall semester at Manchester Community College and Howell Cheney Vocational Technical School, after receipt of all necessary approvals.
3) To form a High Technology Advisory Council to assist Manchester Community College and Howell Cheney Vocational Technical School in this curriculum project and in other related technical areas.

II. PROPOSAL OUTLINE

It is anticipated that the program will be able to accommodate 25-35 full time students per year. It is expected that many students will not be enrolling in the full time program but will be taking only those courses which will assist them in obtaining a job. Flexibility for adult students in entering and existing from educational experiences is important. As indicated previously, a special effort will be made to recruit women students to the program. It is expected that program participants will come with varied backgrounds and educational experiences.

It is anticipated that there will be approximately ten new course proposals developed for the computer technology and maintenance curriculum. These new course proposals will be in the following areas: electronics, fabrication, digital computer circuits, mini-computers, electronic instrumentation and microprocessors. Each new course proposal must be written to adhere to the new course proposal format which is in place at Manchester Community College.

EVALUATION

The program evaluation will be done on an on-going basis by faculty and staff at the College. Numbers of students enrolling in either the full program or taking program courses will be closely monitored. Course instructors will be evaluated periodically and student surveys will be conducted to determine if the course content meets their needs. The Advisory Council will meet on a regular basis and will monitor the program design and advise of any needed changes in curriculum. The role of the Advisory Council is seen as reviewing the curriculum, offering advice regarding technological changes in business and industry and assisting in dissemination of information about the program. The target date for completion of the curriculum is October 1, 1984.

FACILITIES

The collaboration between Manchester Community College and Howell Cheney Vocational Technical School on this project will assure that the necessary technical facilities will be available for operation of the program. Howell Cheney Vocational Technical School will make available their electronics laboratory, their computer laboratory and technology laboratories to students in the program. Manchester Community College also has computer and science laboratories which will be available for use by students.

COMPUTER MAINTENANCE TECHNOLOGY

CURRICULUM
(TWO-YEAR PROGRAM)

FRESHMAN YEAR

First Semester			Second Semester		
	Course	Sem. Hrs.		Course	Sem. Hrs.
EL 113	Electrical Circuits	4	EL 114	Electronic Devices	4
PHY 121	General Physics I	4	PHY 122	General Physics II	4
MA 115	Technical Math I	3	MA 116	Technical Math II	3
EG 111	Introduction to Engineering BASIC Programming & Engineering Drawing	3	EL 120	Logic Circuits I	3
			ENG 114	Technical Report Writing	3
ENG 111	Introductory Composition	3			17
		17			

SOPHOMORE YEAR

First Semester			Second Semester		
	Course	Sem. Hrs.		Course	Sem. Hrs.
EL 121	Logic Circuits II	3	EL 124	Diagnostic Instrumentation	4
EL 122	Mini-Computer Systems I	3	EL 123	Mini-Computer Systems II	3
CS 120	FORTRAN Programming	3	EL 126	Applied Microprocessors	3
SPH 213	Effective Speaking	3		Social Science Elecetive	3
PSY 240	Organizational Behavior	3		Humanities Elective	3
	Social Science Elective	3			16
		18			

MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision ____

2. Name EL113: ELECTRICAL CIRCUITS

3. Description
This course is designed to introduce the student to basic elecrical theory and application. Topics include: electrical safety, electron theory, Ohms Law, scientific notation, resistor codeing, resistor network circuits, soldering skills, Kirchhoff Laws, capacitance, Inductance, Phasor-Algebra and Resonance Circuits. Laboratory exercises will complement all classroom lectures

4. Designation
a. Elective _____ Type _____
b. Required __X__ Program Computer Maintenance Technology

5. Semester Hours 1____, 2____, 3____, 4__X__

6. Prerequisites Math 115 (which may be taken concurrently)

7. Objectives
1. Employ accepted safety procedures in all laboratory exercises.
2. Manipulate the Ohms Law formula in basic electrical circuit problems.
3. Demonstrate mathematical skill in the application of the following prefixes: meg, kilo, micro, nano and micro-micro.
4. Determine the full ohmic value and ohmic tolerance of any randomly selected fixed resistor.
5. Demonstrate skill in the use of DC/AC measurement meters.
6. Demonstrate skill in the soldering and desoldering of common electronic components.
7. Apply theory and practical application to the solution of series, parallel and series-parallel circuits.
8. Apply Kirchhoff Laws to the solution of complex resistive network which deny basic Ohms Law application.
9. Understand and apply capacitance theory to laboratory problems.
10. Understand and apply inductance theory to laboratory problems.
11. Employ Phasor Algebra to reactive circuit solutions.
12. Find the required mathematical solutions to series and parallel circuits in a state of resonance.

8. Instructional Units

A. Introduction
   1. Safety procedures
   2. Protective Devices
      a. Fuses
      b. Automatic Circuit Breakers
      c. Ground Fault Interrupters

B. Structure of Matlen
   1. The Atom
   2. Elements
   3. Electron theory
      a. Conductors and Insulators
      b. Specific resistance

C. Electricity
   1. Power Sources
      a. Chemical
      b. Mechanical
      c. Allied technologies (solar, thermal, etc.)
   2. Electrical Quantities
      a. Voltage
      b. Current
      c. Resistance
      d. Wattage

D. Ohm Law

E. Power Dissipation
   1. Kinetic energy
   2. Wattage
   3. I^2R losses
   4. Electrical rates (Introductory)

F. Scientific Notation

G. Resistor
   1. Variable
      a. Designs
      b. Applications
   2. Fixed
      a. Designs
      b. Color codeing
      c. Application

H. Meters
   1. Analogy
      a. Theory of Operation
      b. Design of shunt and multipiler resistive networks
      c. Electrical measurements
   2. Digital
      a. Basic theory of operation
      b. Electrical measurements

I. Soldering
   1. Tools and material
   2. Hand soldering and desoldering
   3. Wave soldering (field visit possible)

J. Series Circuits
   1. Rules
   2. Problem-solution exercises

K. Parallel Circuits
   1. Rules
   2. Problem-solution exercises

L. Parallel-Series Circuits

M. Kirchhoff Law

N. Capacitance

O. Inductance

P. Phasor Algebra

Q. Resonance Circuits
   1. Series Circuit
   2. Parallel Circuit

Suggested Laboratory Exercises

Week	Experiment
1	Introduction
2	Electricity
3	Resistors
4	Meters
5	Soldering
6	Series Circuits
7	Parallel Circuits
8	Series-Parallel Circuits
9	Capacitance
10	Inductance
11	Filters
12	Series Resonance Circuits
13	Parallel Resonance Circuits
14	Review
15	Review

9. Proposal submitted by: Louis Hailey
Proposal assisted by: John Alberghini

10. Approval Dates

_____ Division

_____ Curriculum Committee

_____ Faculty Senate

_____ _____
Division Director Date

_____ _____
Dean of Academic Affairs Date

MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision _____

2. Name EL114 ELECTRONIC DEVICES

3. Description
This course is designed to acquaint the student with the design, operation, and application of semiconductor devices: Topics include; hole theory, diodes, Zener devices, bipolar transistors, MOSFET, thyristors, tunnel diodes, photo-conductive diodes, LED and I.C. laboratory exercises will complement all classroom instruction.

4. Designation
a. Elective _____ Type_____
b. Required __X__ Program CMT, Computer Maintenance Technology

5. Semester Hours 1_____, 2_____, 3_____, 4 X

6. Prerequisites EL113

7. Objectives
1. Explain the manufacturer and chemical properties of semi-conductive materials.
2. Describe voltage-current characteristics of germanium and silicon diodes.
3. Describe Zener devices design and application.
4. Evaluate bipolar transistors as to:
   A. Operation
   B. Common circuit configuration
   C. Application
5. Evaluate MOS Field-Effect transistors as to:
   A. Operation
   B. Basic circuits
   C. Application
6. Understand operation and application of Thyristors devices.
7. Indentify Tunnel Diode operation and application.
8. Describe PCD and LED theory and operation.
9. Describe the manufacturer and operation of common integrated circuits.

8. Instructional Units

A. Semiconductor Materials
   1. Structure of matter
   2. Donor, acceptor, holes
   3. Biasing

B. Diodes
C. Zeners
D. Biploar Transistors
E. MOSFET
F. Thyristors
G. LED, PCD
H. Intergrated Circuits

Suggested Laboratory Exercises:

Week	Experiment
1	Introduction
2	Diodes
3	Zeners
4	Transistor Biasing
5	Common Emitter Transistor
6	Common Base Transistor
7	Common Collector Transistor
8	MOSFET Inventers
9	MOSFET Gates
10	MOSFET Flip-Flops
11	Thyristors
12	Photo-Conductive Devices
13	Light Emitting Diode
14	Integrated Circuits
15	Review

9. Proposal submitted by: Louis Hailey
   Proposal Assisted by: John Alberghini

10. Approval Dates

_____ Division

_____ Curriculum Committee

_____ Faculty Senate

_____ _____
Division Director Date

_____ _____
Dean of Academic Affairs Date

MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision _____

2. Name EL120: LOGIC CIRCUITS I

3. Description
This course is designed to investigate the design and operation of digital computer circuits common to mini-computer system applications. Topics include: special number systems, logic gates, Boolean Algebra, digital codes, combinational logic, flip-flops systems.

4. Designation
   a. Elective _____ Type_____
   b. Required __X__ Program Computer Maintenance Technology

5. Semster Hours 1_____, 2_____, 3__X__, 4_____

6. Prerequisites EL114 (which may be taken concurrently)

7. Objectives

   A. Perform mathematical operations and hexadecimal number systems to decimal systems.

   B. Employ Boolean algebra to the analysis and simplification of logic circuits.

   C. Assemble, study and debug common digital logic circuits.

   D. Assemble, study and debug circuits common to the flip-flop family.

8. Instructional Units

   A. Special Numbering Systems
      1. Binary numbers
         a. Mathematical Operations
         b. Conversion to decimal

      2. Octal Numbers

      3. Hexadecimal Numbers

B. Logic Gates
   1. Invertier
   2. AND gate
   3. NAND gate
   4. OR gate
   5. NOR gate

C. Boolean Algebra
   1. History
   2. Mathematical Expressions
   3. Rules and Laws
   4. DeMorgan's Theorem
   5. Karnaugh Maps

D. Digital Pulse Waveform Analysis
   1. Four bit code
   2. ASCII (American Standard Code Information Interchange)
   3. Parity and handshake
   4. Serial verses parallel data streams
   5. Asynchronous verses synchronous control

E. Logic Networks
   1. Analysis of logic networks
   2. Gate design by logic equations
   3. Logic network economics
   4. Multi-use NAND gate element
   5. Multi-use NOR gate element
   6. Malfunction analysis of logic networks

F. Special Function Logic Circuits
   1. Exclusive OR
   2. Basic adder
   3. Parallel binary adder
   4. Comparator
   5. Decoders
   6. Encoders
   7. Multiplexers

G. Flip-Flops
   1. Basic set-reset
   2. Leading edge trigger
   3. Master-slave
   4. Toggle
   5. Master-slave JK
   6. Delay
   7. Operational characteristics

Week	Exercises
1	Introdcution
2	Inverter
3	AND gate
	NAND gate
4	OR gate
	NOR gate
5	Digital Pulse Waveform Analysis
6	Logic Networks
7	Special Logic Circuits
8	Flip-Flops
9	Review

9. Proposal submitted by:. Louis Hailey
   Proposal assisted by: John Alberghini

10. Approval Dates

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Dean of Academic Affairs Date

MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision ____

2. Name EL121: LOGIC CIRCUITS II

3. Description
This course is designed to instruct the student in computer logic function of data control, data manipulation and data transfer. Topics include: counters, registers, semi-conductor memories, arithematic operations and input/output functions.

4. Designation
   a. Elective _____ Type _____
   b. Required __X__ Program Computer Maintenance Technology

5. Semester Hours 1____, 2____, 3__X__, 4____

6. Prerequisites EL120

7. Objectives

   1. Review and explain basic logic gates

   2. Assemble, test and troubleshoot
      A. D Flip-Flops
      B. JK Flip-Flops
      C. Shift registers
      D. Counters
      E. Timing circuits
      F. Linear integrated circuits
      G. Tri-state devices

   3. Assemble, test and troubleshoot
      A. IC adder
      B. Comparator circuits
      C. Parity generators
      D. Multiplexers
      E. Encoders
      F. Decoders

   4. Describe circuit operation and debug memories
      A. ROM
      B. RAM
      C. PROM
      D. EPROM

   5. Explain the logic analysis of input/output device control

   6. Describe the operation and architecture of the CPU

8. Instructional Units

A. Basic Logic Gates
B. Counters
    1. Ripple
    2. Module

C. Shift Registers
D. Synchronous counters
E. MSI Counter Units
F. Timing and Control Signals
    1. Index addressing
    2. Short-long instructions
    3. Index register
    4. Interrupts

G. Computer Memory
    1. RAM Bipolan
    2. RAM MOS Static
    3. RAM MOS Dynamic
    4. PROM
    5. ROM
    6. RMM

H. Arithmetic Operations
    1. ALU
    2. Series verses parallel operation
    3. Addition and Subtraction
    4. Signed numbers
    5. Multiplication
    6. Division
    7. Floating point and decimal operations

I. Input/Output Equipment
    1. The handshake
    2. Keyboard
    3. Magnetic tape
    4. Floppy disk and hard disk
    5. Printer and plotters
    6. Modems

Laboratory Exercises

Week	Experiment
1	Introduction
2	Counters and Registers
3	Synchronous counters
4	MS/Counter Units
5	Timining and Control Signals
6	Computer Memory
7	Arithmetic Operations
8	Input/Output Control
9	Keyboard
10	Disk Storage and Printers and Plotters
11	Review

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Proposal assisted by: John Alberghini

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MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision _____

2. Name EL122: MINI-COMPUTER SYSTEMS I

3. Description
This course introduces the student to computer architecture and Assembly Language Programming through the proper study of op-codes and addresses.

4. Designation
a. Elective _____ Type _____
b. Required __X__ Program Computer Maintenance Technology

5. Semester Hours 1_____, 2_____, 3__X__, 4_____

6. Prerequisites EL120 (which may be taken concurrently)

7. Objective

1. Understand Machine-Language Programming
2. Write and load Assembly-Language program
3. Demonstrate skills in computer architecture technology
4. Make a detailed analysis of digital schematic diagrams and digital logic block diagrams
5. Demonstrate skill in debugging Assembly-Language programs

8. Instructional Units
A. Overview of Mini-Computer Programming
B. Review of Special Number Systems
   1. Binary
   2. Octal
   3. Hexadecimal
C. Analysis of the CPU
D. Computer Organization
E. Console Operators
F. Instructions to the Microprocessor
   1. ALU
   2. Control logic
   3. Input/output
G. Logic diagrams
H. Mini-computers malfunction analysis

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MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision _____

2. Name EL123: MINI-COMPUTER SYSTEMS II

3. Description
This course deals with the study of magnetic recording methods common to mini-computer data storage techniques. Subject matter will include: magnetic theory, recording fundamentals, pulse recording methods, recording malfunctions, disk drive assembly electro-mechanics, disk drive alignment and maintenance, and interpretive diagnostics.

4. Designation
a. Elective _____ Type_____
b. Required __X__ Program CMT, Computer Maintenance Technolgy

5. Semester Hours 1_____, 2_____, 3__X__, 4_____

6. Prerequisites EL122

7. Objectives

1. Demonstrate an understanding of basic magnetic recording techniques.

2. Demonstrate an understanding of the electro-mechanics of disc drive operation and repair.

3. Demonstrate an understanding of magnetic tape transport concepts and operation.

4. Insolate malfunctions to failing area of logic by:
   A. Pursuing a troubleshooting procedure through the use of diagnostic programs and computer front panel test.

   B. Employ accepted documentation as a troubleshooting tool (Block diagrams, logic prints, signal list, diagnostic listings and flow diagrams).

   C. Develop diagnostic routines in machine coding and insert them into the processor for the purpose of troubleshooting the disc and tape systems.

8. Instructional Units

I. Magnetic Recording
   A. Magnetic theory
   B. Recording fundamentals
   C. Pulse recording methods
      1. Return-to-zero
      2. Return-to-zero with prebias
      3. Double pulse return to zero

   D. Factor affecting magnetic recording
      1. Mechanical Skew
      2. Electrical Skew
      3. Packing density
      4. Prerecorded medium

   E. Level recording methods
      1. Non-return to zero
      2. NRZI
      3. Modified NRZI
      4. Phase modulation
      5. Miller encoding

II. Disk Principles
   A. Types of disk and disk units
      1. Comparative analysis of disk and disk units
      2. Removable and non-removable disk

   B. Read/Write Heads
      1. Head support
      2. Flying head
      3. Contact head
      4. Contact start/stop head
      5. Head mobility-fixed head, movable head

   C. Head Positioner
      1. Purpose
      2. Linear motor
      3. Stepping motor
      4. Hydraulic positioner
      5. Printed circuit motor

   D. Closed Loop Servo System
      1. Purpose
      2. Summing networks
      3. Converter
      4. Positioner
      5. Carriage assembly
      6. Feed back network

   E. General maintenance
      1. Air system-filters
      2. Temperature control
      3. Headcrash or head to disk interference
      4. Brushes

III. Tape Concepts

A. Types of Tapes and Transports
   1. Comparative analysis of each

B. Tape Movement
   1. Function
   2. Types: a. Single capstan vacuum drive
      b. Single capstan friction drive
      c. Dual capstan pinch roller drive
   3. Capstan Alignment
   4. Tape guide

C. Buffering Systems
   1. Purpose
   2. Vacuum columns
   3. Tension arms
   4. Tape wrap
   5. Tape speed
   6. Sensors
   7. Operation of tension arm unit

D. Recording Process
   1. Dimension and characteristics of magnetic tape
   2. Tape transport head
   3. Tape formatting
   4. 7-Track NRZI
   5. 9-Track NRZI
   6. 9-Track Phase Encoded

E. Motion Control
   1. Tape speed ranges
   2. Motion control sequencing
   3. Data cell time formula

F. General Maintenance
   1. Preventive maintenance
   2. Skew, types of
   3. Skew, causes of

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MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision _____

2. Name EL124: DIAGNOSTIC INSTRUMENTATION

3. Description
The course enables the student to develop extensive "hand-on" experience with computer laboratory equipment required for both testing and repair of computer circuits and systems. The subject of maintenance and calibration of electronic laboratory equipment will also be stressed.

4. Designation
   a. Elective _____ Type _____
   b. Required __X__ Program Computer Maintenance Technology

5. Semester Hours 1_____, 2_____, 3_____, 4__X__

6. Prerequisites EL121

7. Objectives

   1. Define error in measurement of readings.
   2. Describe the design and operation of D.C. measurement instrumentation.
   3. Describe the design and operation of A.C. measurement instrumentation.
   4. Explain the need and use of potentiometer standards.
   5. Describe the design and application of D.C. bridges.
   6. Expalin the design and application of A.C. bridges.
   7. Demonstrate skill in the operation of the oscilloscope.
   8. Demonstrate skill in the use of single and multi purpose analog and digital meter devices.
   9. Explain transducer operation and selection.
   10. Demonstrate skill in the utalization of data acquisition instrumentation.

8. Instructional Units

A. Measurement and Error

1. Definitions
2. Accuracy and precision
3. Significant figures
4. Types of error
5. Statistical analysis
6. Probability of errors
7. Limiting errors

B. Direct-Current indicating instruments

1. Suspension galvanomenter
2. Permanent-magnet moving coil mechanism
3. Galvanometer sensitivity
4. d.c. ammeters
5. d.c. voltmeters
6. Voltmeter sensitivity
7. Voltmeter-ammeter method
8. Series type ohmmeter
9. Shunt type ohmmeter
10. Multimeter or V.U.H.
11. Calibration of d.c. meters

C. Alternating Current Indicating Instruments

1. a.c. ammeters
2. a.c. voltmeters
3. Sensitivity

D. Principles and Applications of Potentiometers

1. Potentiometer circuits
2. Volt box
3. Shunt box
4. Calibration or potentiometric circuits
5. Wheatstone Bridge
6. Kelvin Bridge
7. Loop tests with the portable test set
8. Guarded Wheatstone bridge
9. General form of the a.c. bridge
10. Comparison bridges
11. Maxwell bridge
12. Hayes bridge
13. Schering bridge
14. Unbalanced conditions
15. Wien bridge
16. Wagner groun connection
17. Universal bridge

E. Oscilloscopes

1. Basic CRT operation
2. Cathode ray tube
3. Vertical deflection system
4. Delay line
5. Horizontal deflection system
6. CRO probes
7. Lissajous figures
8. Special purpose CRO's

F. Analog and Digital Acquistion Systems

1. Instrumentation systems
2. Magnetic recorders
3. Digital-to-analog coversion
4. Analog to digital conversion
5. Multiplexers
6. Lasers
7. Fiber optics

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MANCHESTER COMMUNITY COLLEGE

COURSE PROPOSAL

1. New Course __X__ Course Revision _____

2. Name EL126: APPLIED MICROPROCESSORS

3. Description
This course is designed to instruct the student in the theory and application of microprocessors. A state of the art microprocessor chip will be thoroughly examined. Hexadecimal mathematics and microprocessor assembly language programming will be explored. Several microprocessor chips (6502,Z80,8080,) will be overviewed.

4. Designation
a. Elective ____ Type_____
b. Required __X__ Program Computer Maintenance Technology

5. Semester Hours 1_____, 2_____, 3__X__, 4_____

6. Prerequisite NONE

7. Objectives

A. Convert between decimal, binary, octal and hexadecimal number system.

B. Perform mathematical computations in any of the four number system.

C. Be familiar with and be able to use any of the selected microprocessor's addressing modes.

D. Be able to write and debug complex programs in assembly language of the selected microprocessor.

E. Be able to interface the selected microprocessor with/to a variety of applications.

F. Be familiar with the similarities and differences in a variety of 8 and 16-bit microprocessors.

8. Instructional Units

A. Hexadecimal Number System
1. Conversion between bases
2. Hexmathematics

B. Microcomputer Basics
1. Overview of microprocessor and microcomputers
2. Terms and conventions
3. RAM, ROM, and I/O conventions-overview

C. Addressing Modes
   1. Inherent
   2. Accumulator
   3. Immediate
   4. Direct
   5. Extended
   6. Indexed
   7. Relative

D. Microprocessor Software
   1. Instruction Set
   2. Assembler
   3. Programming Format

E. Microprocessor Hardware
   1. Registers
   2. Random Access Memory
   3. The Microprocessor (MPU)
   4. Peripheral Interface Adapter (PIA)
   5. Asynchronous Communications Interface Adapter (ACIA)

F. Interfacing
   1. Fundamentals
   2. Interfacing with RAM
   3. Interfacing with Display

G. Associate Microprocessors
   1. 6502
   2. 280
   3. 8080
   4. 16 bit microprocessors

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